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FURTHER CONTRIBUTIONS TO THE KNOWLEDGE OF THE SIPHONAPTERA.

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(Plates IX. X.).

1. *Ceratophyllus terribilis* spec. nov. (Pl. IX. fig. 1. 2. 3).

Head.—The head (fig. 1. ♂) is somewhat longer than it is broad, and bears a row of short stout spine-like hairs between the upper end of the antennal groove and the ventral corner of the frons. The frons is much more strongly curved in the *male* than in the *female*. The hinder portion of the head is hairy above. It bears also numerous short hairs at the sides above the antennal groove. A hair above the hinder ventral corner, another in the middle above the antennal groove, and four others situated in front of the eye are long and stout. The palpus is considerably shorter than the rostrum.

Thorax.—The pronotal comb (fig. 1) consists of twenty-two teeth. The mesonotum is densely clothed with numerous short hairs, in addition to the ordinary row of bristles. The epimerum of the metathorax bears one bristle on its hinder edge, and a row of three or four more situated immediately below the stigma. In addition to these the epimerum bears a few scattered hairs on the proximal portion of its surface.

Abdomen.—The first three abdominal tergites bear a small spine on each side. The seventh tergite has on each side three apical bristles, two long and one short, the latter being the most ventral of the three.

The abdominal sternites 2 to 7 have three hairs on each side.

Legs.—The anterior femur bears numerous fine hairs scattered over its outer surface. The foretibia is short, and ventrally and dorsally rounded (in optical section), the bristles on the dorsal edge being very numerous, but not long. The first segment of the tarsus is about half as long as the tibia, with seven pairs of long thin bristles on its dorsal edge.

The midtibia bears ten pairs of long thin bristles on its dorsal edge, and two subdorsal rows of hairs on the outer surface and a number of ventral bristles as well. The first segment of the midtarsus is half as long as the tibia and very densely covered with hairs.

The posterior tibia bears on its outer side two subdorsal series of hairs and numerous ventral bristles; on the inner side only one row of hairs is present. The tibia, moreover, bears thirteen or fourteen pairs of bristles on the dorsal edge. The first segment of the hindtarsus is about three-quarters the length of the tibia,

and is densely covered with fine hairs, as are all the tarsal segments. The second segment is only half the length of the first segment, its longest apical bristle not quite reaching the middle of the fourth segment. The fifth segment (exclusive of claw) is a little longer than the third.

Modified Segments.*—In the *male* the eighth tergite bears at its hinder edge twelve to fourteen long bristles, placed quite close together. The eighth sternite is rounded and truncate at the end, with its upper corner produced into a lobe, which is densely beset with long bristles at its edge (fig. 2). The ninth tergite is very characteristic. The process of the clasper is acuminate, the manubrium being strongly curved and obtuse at the end. The movable finger is a little shorter than the process of the clasper, and somewhat shaped like a half-crescent, being convex on the hinder and concave on the anterior or "upper" side.

In the *female* the apical edge of the eighth tergite (fig. 3) is sinuate. The number of bristles is not quite constant. There is one long solitary bristle beneath the stigma. The three upper bristles situated near the apical edge are short and stout. The eighth sternite bears one very small hair at the apex.

Length. 3.3 mm.

We received ten specimens of this interesting species from Mr. G. F. Dippie, taken from *Lagomys princeps* :—

4 ♂♂, Canadian National Park, Alberta, Canada, July 26, 1899.

5 ♀♀, " " " " " " "

1 ♀, Banff, Alberta, Canada, July 26, 1899.

2. *Stephanocircus thomasi* spec. nov.† (Pl. IX. fig. 4. 5).

Head.—The frontal portion of the head (fig. 4) is very long. It is again separated into an upper part (H) corresponding to the "helmet" of the other species of *Stephanocircus* and into a lower or genal part (G). The upper part bears at its ventral and posterior edges a series of heavy spines (fig. 4). Eight of these are situated at the ventral edge. Of these spines, the first is situated apart from the rest, the one spine at the angle being about twice as long as any of the other spines. The three spines at the hinder edge are short, gradually decreasing in length. There are no genal spines. The palpi are shorter than the rostrum, the latter reaching beyond the apex of the forecoxa.

Thorax.—The pronotal comb consists of twenty-seven teeth. The epimerum of the metathorax bears two vertical rows of hairs, consisting of three hairs each, and in addition a single ventral hair.

Abdomen.—The first four tergites bear a comb consisting of 26, 22, 21 and 12 teeth respectively, the teeth standing close together. The seventh tergite has at its apical edge on each side three or four long bristles, of which the second is the longest and the most dorsal one the shortest.

The first abdominal sternite bears a curved row of about seven bristles on each side, and a number of shorter hairs situated immediately in front of this row. The third, fourth and fifth sternites have three or four bristles.

Legs.—The bristles of the legs are slender, those of the very slender tarsi being also extremely short (fig. 5).

* The more posterior segments, that is to say, segments 8 to 10, of the majority of the *Siphonaptera*, are considerably modified for sexual purposes, and are throughout the present article described separately from the rest.

† This species is named in honour of Mr. Oldfield Thomas, F.R.S., the British Museum.

The curved apical bristle of the hindfemur is shorter than the bristle similarly placed on the anterior legs. The outer side of the hindtibia is very hairy (fig. 5). The first and third dorsal pairs of bristles situated on the tibia (counting from the apex) are more than half the length of the tibia. The first segment of the hindtarsus is only one-fourth shorter than the tibia. The stout apical bristle of this segment does not reach to the middle of the second segment. The fourth tarsal segment is short, measuring scarcely twice its own breadth.

Modified Segments.—The eighth tergite (♀) is angulate, bearing an irregular series of apical bristles, and a further series of somewhat longer ones close to its edge, besides two or three slender proximal bristles.

Length, 3.4 mm.

The type, a *female*, is unique, and was taken from *Mus ferculinus* Thos. on Barrow Island, North-West Australia, in 1901, by J. Tinney, who was then collecting for the Perth (West Australia) Museum.

3. *Stephanocircus minerva* spec. nov. (Pl. IX. fig. 6. 7.).

The present species is closely allied to *S. mars**, but is abundantly distinct from it, differing in the following characters.

Head.—The posterior edge of the helmet-like portion of the head is densely clothed with very short hairs. There are only five genal spines (fig. 6).

Thorax.—The pronotal comb consists of twenty-five teeth.

Abdomen.—The short triangular spines situated at the apical edges of the first four abdominal tergites are much more numerous than in *S. mars*. The first segment bears 11 such spines on the two sides taken together; the second, 12; the third and fourth, 9 each; the fifth, 3; and the sixth, 2.

Legs.—The femur of the present species lacks the row of lateral bristles on its inner side. There are a number of bristles, however, situated near its apex. These subapical bristles are fewer in number than those similarly placed in *S. mars*. In *S. mars* the longest dorsal apical bristle of the hindtibia reaches to the apex of the first tarsal segment; in the present species this bristle is quite a third shorter (fig. 7). The corresponding bristle of the fore- and midtibiae are also much shorter in the present species than in *S. mars*. The hindcoxa bears both in *S. mars* and in this species a comb similar to that present in the genus *Pulex*. It may possibly be of interest to note that in the Australian species† just described (*S. thomasi*) this comb is absent. The coxae too are more elongate in *S. thomasi*.

Modified Segments.—The eighth tergite (♀) of the present species is more rounded at the apex, and bears many more bristles than that of *S. mars*.

Length, 3.2 mm.

We received two *female* specimens of this species from Mr. William Foster taken from *Didelphys azarae*, near Sapucay, Paraguay, in 1901.

4. *Ceratopsylla insignis* spec. nov. (Pl. IX. fig. 8—12).

Head.—The flaps of the head are not narrowed at their apices. There is a very long bristle situated on the hinder part of the head, immediately above the antennal groove. Three short bristles, with a few more situated in front of

* Nov. Zool., v. p. 544. t. 14. f. 11 (♀) (1898).

† In the Australian *Stephanocircus dasyuræ* Skuse, this comb is also absent. We have one ♀ of *S. dasyuræ* found at Williams, West Australia, on *Bettongia penicillata*.

them, are placed at the ventral angle of the hinder portion of the head immediately behind the antennal groove. The bristles on the posterior portion of the head are numerous.

Thorax.—The pronotal comb consists of thirty-six teeth. The mesonotum bears on each side, before the apex, two slender teeth. On the metathorax there is a "comb" (fig. 8, C), which is not homologous to the combs found on other species of Siphonaptera, being a development from the subapical row of long bristles found in these insects. This is clearly demonstrated by the thoracic and abdominal combs of the present species gradually merging into the ordinary bristles of that series, as is shown in the figure. The lateral teeth of this "false" comb do not stand at the edges of the segments; the shorter and more central teeth, however, have acquired this position in consequence of the apical margins of the segments being dorsally sinuate. The teeth of the metathoracic comb are much less modified than those composing the combs of the first four abdominal tergites. The epimerum of the metathorax bears a number of bristles. One of these is situated behind the stigma. Three more are placed at the hinder edge, of which the upper two are nearly of the same length, while the third is shorter and thinner. In addition to these, there are seven or eight more bristles, as shown in the figure.

Abdomen.—On the first seven tergites, combs similar to that on the metathorax are present. The modification of the bristles into a comb-like structure is least advanced on the sixth and seventh tergites, where only two to four bristles have become shortened and thickened. These bristles do not stand exactly at the edge of the segments, the small sinus not being sufficiently deep. The number of teeth in the abdominal false combs varies considerably in individuals. The comb on the first tergite consists of from ten to twelve teeth. The number of teeth present in the abdominal combs gradually decreases. The first three tergites bear two irregular series of hairs, in addition to the posterior row of long bristles; the remaining tergites, however, bear only one row of short hairs, besides the long ones of the posterior row. The seventh tergite in both sexes bears one long apical bristle on each side, situated on a cone.

The third, fourth, fifth and sixth sternites of the *male* bear from three to four bristles on each side, while the seventh segment bears a row of from seven to nine. In the *female* these hairs are considerably longer, and occasionally more numerous.

Legs.—The posterior femur bears four subapical bristles, two of which are lateral and two subventral. There are three pairs of bristles on the ventral side near the base. The hindtibia is clothed on the outer side with two rows of hairs, and bears, in addition, a number of shorter ones situated more ventrally.

Modified Segments.—The eighth tergite of the *male* is sinuate below the stigma, and produced upwards behind this sinus into a broad lobe (fig. 9). This lobe bears three long bristles, and there are in addition a number of marginal hairs above these bristles. The ventral distal edge of the segment is minutely serrate. The eighth sternite (fig. 11) is somewhat sole-shaped, and bears numerous short hairs. On the inner side there are brushes of long hairs similar to the brushes found in the following insect. Of the clasping organs the broad process P (fig. 10) is very conspicuous on account of the six or seven long bristles situated in a row at its apex. The finger (F) is square, and its upper proximal corner is produced into a short conical process, bearing a short spine near the tip.

The eighth tergite of the *female*, as seen in the mounted specimen, is represented by fig. 12. The hairs are numerous.

Length 2.9 mm.

We received twelve specimens, 3 *male* and 9 *female*, of this interesting species from Mr. G. F. Dippie. They were taken from *Myodes lucifugus* on July 2nd, 1900, near Waterloo, Ontario, Canada.

5. *Ceratopsylla wolffsohni* spec. nov. (Pl. IX. fig. 13; Pl. X. fig. 14—16).

Head.—The anterior part of the head is shorter, and the second frontal flap slenderer, than in *C. insignis*. The head in other respects is similar to the head of that species.

Thorax.—The pronotal comb consists of from twenty-seven to twenty-nine teeth. The mesonotum has two slender bristle-like teeth on each side before the apex. On the metanotum there are laterally at the edge two short strongly chitinised teeth. Above these the segment is sinuate, so that the bristles of the subapical series become apical (fig. 13), resembling a comb as in *insignis*. The epimerum of the metathorax has two or three proximal hairs, a longer hair behind the stigma, another still longer placed farther down, and two more at the hinder edge (fig. 13).

Abdomen.—The first abdominal tergite resembles the metanotum in structure. The dorsal apical bristles, however, are still more tooth-like. On the other tergites the long bristles remain normal in position and length. The fourth, fifth and sixth tergites have only two small hairs in front of the row of bristles. The seventh tergite bears on each side one long apical bristle, which is situated on a cone, and has on each side of it a very small hair.

The sternites of the fourth, fifth and sixth segments have in the *male* one hair and in the *female* four hairs on each side; the sternite of the seventh segment, however, bears a few more hairs in addition to these in both sexes.

Legs.—The legs of this insect resemble those of *C. insignis*.

Modified Segments.—The eighth tergite of the *male* is strongly rounded-dilated anad, and bears a patch of bristles at the apex. At the upper edge of the dilated portion of the tergite (fig. 14) there is a row of short hairs, while the oblique ventral edge is minutely serrate. The eighth sternite (fig. 15) is small and gradually widened anad, bearing at the apical edge a row of bristles placed closely together. Above this sternite there are two pieces of chitin, densely clothed with long fine hairs, being brush-like in appearance. These brushes represent apparently the ninth sternite. The clasper (fig. 16) is produced into a somewhat elliptical process (P), which bears at the end two long bristles. The movable finger (F) is not longer than this process, but much broader, being triangular, with the ventral edge shortest and the hinder edge longest. The finger has no long hairs, and is, in optical section, dorsal of the process of the clasper.

The eighth tergite of the *female* is similar to that of *C. insignis*, but some of the hairs are absent.

Length 2.1 mm.

We have received a very large series of this flea from Mr. William Foster, taken near Sapcay, Paraguay (*type*), from various hosts—*Myotis nigricans*, *M. albescentis*, etc., etc. Mr. J. A. Wolffsohn, in whose honour this species is named, also forwarded us two *female* specimens taken from *Vespertilio nigricans* at Valparaiso, Chili.

6. *Ceratopsylla martialis* spec. nov. (Pl. X. fig. 17—20).

Head.—Both flaps of the head are long, the first being rounded at the end, the second acuminate. A regular series of hairs extends from the base of the first flap to the insertion of the antenna, the hairs composing it being rather stout. The posterior part of the head in the ♂ is longer than in the ♀. There is a regular series of short but stout hairs placed along the antennal groove. The hinder part of the head bears, besides, four or five transverse series of bristles, of which the lateral ones are somewhat long. Ventrally at the hinder edge of the posterior portion of the head there is a series of from five to seven bristles, which stand close together, are spinelike, and gradually decrease in length, the uppermost being the longest (fig. 17).

Thorax.—The pronotal comb consists of twenty-two teeth. All three thoracic segments are densely clothed with hairs on the back. The pronotum is longer than it is posteriorly broad, and the metanotum is twice as long as it is posteriorly broad (when viewed in optical section). The metanotum bears three teeth on each side at the apical edge. The mesonotum has the two usual pointed teeth at the side, and a third close to the ventral edge. The epimerum of the metathorax bears fifteen bristles, of which two stand near the hinder edge.

Abdomen.—The basal edges of the abdominal tergites are incrassate. The first and second tergites bear an apical tooth on each side. The first tergite, moreover, bears three, and the second two rows of hairs besides the ordinary row of long bristles. There are also a few additional hairs on the back.

The third, fourth, fifth, sixth and seventh abdominal sternites bear in the ♂ two or three, in the ♀ four, bristles on each side.

Legs.—The first segment of the foretarsus is one-third shorter than the second segment.

The first segment of the midtarsus is one-fifth longer than the second.

Along the ventral side of the hindfemur there are from base to apex about twelve bristles. On the outer side of the hindtibia there are three rows of hairs, of which only the posterior one is regular; on the hinder edge of the tibia there are, besides numerous short bristles, a subbasal pair, a single median one, a shorter subapical one, and an apical pair of prolonged setae. The first segment of the hindtarsus is half as long again as the second. The fourth segment of the hindtarsus is elongate, while the third segment is half the length of the first. The hairs of the tarsi are short and numerous, the first hindtarsal segment bearing laterally a series of ten pairs.

Modified Segments.—The sternite of the eighth abdominal segment of the *male* is prolonged, and bears at its apical edge a row of six bristles (fig. 18). The process of the clasper (fig. 19, P) is large, truncate, with the upper inner angle rounded; it bears at the upper outer angle two bristles. The movable finger (fig. 19, F) is gradually widened at the apex, being somewhat club-shaped. It has at the anal edge four bristles, namely, a long one at the upper angle, and three thinner ones farther down. There are, besides, five short hairs near the upper angles.

The eighth abdominal tergite of the *female* (fig. 20) bears near the apical edge a series of five short and stout spines placed close together, and a number of longer bristles, as shown in the figure. These bristles are placed as follows: two between the stigma and the series of five spines, and six arranged in two groups of three at the apical edge. There are also six or seven more bristles

situated more ventrally and proximally. The eighth sternite (*st*), however, lacks any bristles whatever.

Length: 2.9 mm.

Ten specimens (five *males* and five *females*) of this species were received from Mr. Sikora. They were taken at Plaine des Palmes, in the Island of Réunion, on *Nyctinomus acetabulosus*.

7. *Ceratopsylla caminae* spec. nov. (Pl. X. fig. 21, 22).

Head.—Both flaps of the head are acuminate, the second being twice the length of the first. Some very short and fine hairs are scattered irregularly over the surface of the anterior part of the head. The posterior portion of the head is nearly twice as long (measured laterally) as the anterior part in the ♂, while the two portions are of nearly equal length in the ♀.

Thorax.—The comb of the pronotum consists of twenty-four teeth. The mesonotum (when viewed in optical section) is more than twice as long as it is broad (excluding epimerum and episternum). It bears, besides the two slender lateral and subapical teeth, two series of hairs and a few single bristles. The epimerum of the metathorax (fig. 21, *epmt*) has one hair below the stigma. In addition to this there are four hairs more ventral in position, two being proximal and two subapical, and one hair at the apical corner. The metathoracical comb consists of twenty-three teeth.

Abdomen.—The comb of the first abdominal tergite is vestigial, having only four short teeth (fig. 21, *t'*). The number of teeth of the other five abdominal combs is in the ♂ 24, 21, 18, 17, 18 respectively, and there are a few teeth more in the combs of the ♀.

The sternites of the fourth, fifth and sixth abdominal segments have three hairs on each side in both sexes.

Legs.—The coxae are elliptical. The hindfemur has two subapical hairs, the one placed subventrally, the other laterally. The hindtibia bears one series of lateral hairs on the outer side. The bristles of the legs are short, the longest apical bristle of the hindtibia being little more than one-third the length of the first hindtarsal segment.

Modified Segments.—The eighth sternite of the *male* is somewhat bottle-shaped, being rather strongly narrowed from the apical third to the end (in lateral view). The narrow apical portion is beset with a number of long and short bristles. The clasper (fig. 22) is elongate-ovate, the process P and the finger F taken together. The finger is very narrow and curved. It bears a few thin and short hairs, of which the one situated at the upper third of the convex edge is the most conspicuous.

The eighth tergite of the *female* is truncate sinuate distally, and bears very numerous hairs.

Length: 2.1 mm.

We have received three specimens of this interesting species: one *male* and two *females*, from Bannertel, West Australia, taken by Mr. B. Woodward of the Perth (West Australia) Museum, on August 20th, 1900, from a bat.

8. *Ceratopsylla reductus* spec. nov.

This insect is very closely allied to *C. caminae*. It is probably the Eastern Australian representative of the latter. It differs from *caminae* in the reduced

numbers of spines in the combs, the numbers being in the *male* 23, 2, 20, 16, 16, 13, 13, and in the *female* 15, —, 13, 11, 10, 10, 10. It will be noticed from these figures that, in contradistinction to *C. caminae*, the *male* has more spines than the *female*. The metathoracical epimerum of the *female* has a few more proximal hairs in *reductus*, while the eighth tergite of *reductus* has a few less than *caminae*. The eighth sternite of the *male* bears fewer hairs at the apex than in *caminae*, and the narrowed apical portion is shorter than in that species. There are apparently no differences in the clasping organs of the two species.

We received one pair from Mr. Le Souëf, taken in Melbourne, Victoria, on *Espertilio macropus*.

9. *Ceratopsylla fosteri* spec. nov. (Pl. X. fig. 23—26).

Head.—The head and thorax are long. The anterior portion of the head is about as long as the posterior, being covered at the sides with numerous spines (fig. 23). Those near the antennal groove are strongly chitinised. The spinose area covers the upper two-thirds of the lateral surface of the head. There is a series of about ten short and stout bristles on the hinder part of the head along the antennal groove. The hinder part of the head (like the three tergites of the thorax) shows several incrassations internally, which appear in optical section as dark brown bands. The two flaps of the head are neither acuminate nor curved. The anterior one is broad, being about twice as long as it is basally wide.

Thorax.—The pronotum is shorter than it is apically broad (teeth excepted), and bears a comb of twenty-four teeth (fig. 23). The mesonotum and metanotum are about equal in length, their bristles being stout like those of the prothorax. The comb of the metanotum consists of twelve teeth. The epimerum of the metathorax is longer than it is broad, acuminate, and bears three bristles below the stigma, standing in a triangle, the posterior of them being the longest. In addition there is one bristle behind the stigma and one at the apical angle.

Abdomen.—The bases of the tergites are incrassate internally. The four combs on the abdominal tergites consist of 21, 16, 17 and 16 teeth respectively.

The abdominal sternites are also incrassate internally near the base. Those of segments 5 and 6 have three bristles on each side. The sternite of the seventh segment of the *female* is irregularly triangular in lateral view, and bears nine or ten hairs on each side. The eighth sternite of the *male* is elongate, and bears ventrally before the apex a number of short hairs (fig. 24, *viii. st.*).

Legs.—The first segment of the foretarsus is as long as the second.

The first segment of the midtarsus is one-fourth longer than the second. The midcoxa is as broad as it is long. The mid- and hindfemur have some hairs ventrally near the base, but none on their lateral surfaces. The tibiae are short when compared with the tarsi.

The hindtibia has on the outer surface one row of rather long hairs and several hairs on the inner surface. At the hinder edge of the hindtibia there are six pairs of bristles. The hindtarsus is two and a half times as long as the hindtibia; its fourth segment is only slightly over half as long again as it is apically broad.

Modified Segments.—The process P (fig. 25) of the clasping organ of the *male* is large, triangular, and bears on the lateral surface a number of stout bristles. The finger F (of which the exact outline cannot be very clearly made

